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☐ 1. Document ID: US 20030231348 A1

Using default format because multiple data bases are involved.

L11: Entry 1 of 8 File: PGPB Dec 18, 2003

PGPUB-DOCUMENT-NUMBER: 20030231348
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20030231348 A1

TITLE: Image processing method and image processing apparatus

PUBLICATION-DATE: December 18, 2003

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Ishii, Akira	Nakai-machi		JP	
Ogi, Kenji	Nakai-machi		JP	

US-CL-CURRENT: 358/3.03; 358/3.01, 358/521

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw Desc | Ima

☐ 2. Document ID: US 20030137699 A1

L11: Entry 2 of 8 File: PGPB Jul 24, 2003

DOCUMENT-IDENTIFIER: US 20030137699 A1
TITLE: Method of changing halftone dot area, and device and program for processing halftone data

Abstract Paragraph:
A method of changing a halftone dot area is provided. The method includes: performing an expansion process on rasterized binary halftone image data to generate multi-level halftone image data; processing the expanded halftone image data using an averaging mask to convert the expanded halftone image data into multi-level halftone image data having intermediate gradation levels; performing a gradation conversion on the multi-level halftone image data having the intermediate gradation levels based on a predetermined tone curve to perform a spreading/shrinking process for changing a density in an edge portion of a halftone dot; and performing an error diffusion process based on the corrected gradation to represent gradation in the form of small dots having densities corresponding to original gradation levels, thereby generating halftone data for proof in which the halftone dot area is changed in accordance with the output characteristic of an output device.

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Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw Desc | Ima

☐ 3. Document ID: US 20020181987 A1

L11: Entry 3 of 8 File: PGPB Dec 5, 2002

DOCUMENT-IDENTIFIER: US 20020181987 A1
TITLE: Image processing device, printing control device, image processing method and recorded medium

Detail Description Paragraph:
[0065] The subsequent tone number conversion module applies the error diffusion method to the dot density data of the small size dot and the medium size dot, which are obtained by referring to this dot density table, so as to convert the dot density data into a specific expression format based on the on-off state of the small size dot and the medium size dot. The large size dot generation module generates data expressing the on-off state of the large size dot from data expressing the on-off state of the small size dot and the medium size dot. This series of processing accordingly gives data of the specific expression format based on the on-off state of the small size dot, the medium size dot, and the large size dot.

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw Desc | Ima

☐ 4. Document ID: US 20010021275 A1

L11: Entry 4 of 8 File: PGPB Sep 13, 2001

DOCUMENT-IDENTIFIER: US 20010021275 A1
TITLE: Image processing method, image processor, and storage medium thereof

Summary of Invention Paragraph:
[0006] However, a shortcoming of the error diffusion method is the generation of geometric texture, such as the texture generated in the low density dot area (area where the density of block dots is low) of the output image (this texture is called "worm"), and the texture generated in the high density dot area (area where the density of black dots is high) (this texture is called "fingerprint"), and many improvements have been attempted in the prior art. The improvement techniques which have been proposed will be described below.

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw Desc | Ima

☑ 5. Document ID: US 6602003 B2

L11: Entry 5 of 8 File: USPT Aug 5, 2003

DOCUMENT-IDENTIFIER: US 6602003 B2
TITLE: Image processing device, print control device, image processing method, and recording medium

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Detailed Description Text (12):
The subsequent tone number conversion module applies the error diffusion method to the dot density data of the small size dot and the medium size dot, which are obtained by referring to this dot density table, so as to convert the dot density data into a specific expression format based on the on-off state of the small size dot and the medium size dot. The large size dot generation module generates data expressing the on-off state of the large size dot from data expressing the on-off state of the small size dot and the medium size dot. This series of processing accordingly gives data of the specific expression format based on the on-off state of the small size dot, the medium size dot, and the large size dot.

☑ 6. Document ID: US 6563604 B1

L11: Entry 6 of 8 File: USPT May 13, 2003

DOCUMENT-IDENTIFIER: US 6563604 B1
TITLE: Method of gradation reproduction

Detailed Description Text (8):
A dot position decision means 106 determines coordinates of the dot, whose dot size is determined by the dot size decision means 105, and it determines coordinates of the dot by referring to the image data output by the error diffusion calculation means 109. An image output means 110 stores a tone modulated image, for which a dot in the dot size output by the dot size decision means 105 is set on the coordinates determined by the dot position decision means 106.

Detailed Description Text (10):
The error data calculated by the error calculation means 107 is stored in an error storage means 108, and it is forwarded to the error diffusion calculation means 109. The error diffusion calculation means 109 carries out calculation of an error diffusion by referring to the error data stored in the error storage means 108 and the object pixel data obtained by the pixel data obtaining means 101. The error diffusion calculation means 109 then outputs data, which is derived by weighting on the object pixel data with the error data, to the dot size decision means 105 and the dot position decision means 106.

Detailed Description Text (20):
The dot position decision means 106 is supplied with the dot size information output by the dot size decision means 105 and the image data "DATA'" weighted on the object pixel data with the error data of a previously processed pixel and output by the error diffusion calculation means 109. The dot position decision means 106 compares the weighted image data "DATA'" input to it with a threshold value "th" for determining dot coordinates, and outputs dot coordinates for a dot of a pixel that satisfies DATA'>th. The dot coordinates data and the dot size information determined here are transferred to the image output means 110, which in turn outputs upon the determined coordinates as a standard position data of a dot in a size corresponding to one of those shown in FIG. 3 according to the dot size information. After the determination of dot coordinates, the error calculation means 107 calculates an error in the object pixel.

Detailed Description Text (24):
The error data calculated by the error calculation means 107 is transferred to the error storage means 108, and it is stored in a memory corresponding to the dot coordinates determined by the dot position decision means 106. The error data stored in the error storage means 108 is referred to by the error diffusion calculation means 109, when it performs a weighting transaction of the error data for the object pixel. During this

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transaction, an error matrix similar to the one utilized in the error diffusion as shown in FIG. 10 is applied to the data in the error storage means 108, to weight error data for the neighboring pixels adjacent to the object pixel. The object pixel data "DATA'" that has been weighted and output from the error diffusion calculation means 109 is referred to by the dot size decision means 105 and the dot position decision means 106.

☐ 7. Document ID: US 6515768 B1

L11: Entry 7 of 8 File: USPT Feb 4, 2003

DOCUMENT-IDENTIFIER: US 6515768 B1
**** See image for Certificate of Correction ****
TITLE: Frequency modulation halfstone screen and method for making the same

Brief Summary Text (14):
Perhaps the best known of all "frequency modulation" methods is the error diffusion algorithm. It comes in many variations, but the principle is always the same: the error that occurs as a result of the binarization (or, in a more general context, the quantization) of the image data during the rendering is "diffused" to one or more of the unprocessed pixels. Best known is the Floyd and Steinberg algorithm (Floyd, R. W., and L. Steinberg, "An Adaptive Algorithm for Spatial Greyscale", Proc. SID, vol. 17/2, pp. 75-77). Many variations exist, usually differing in the number of pixels to which the error is diffused and how the error diffusion weights are randomized. The error diffusion techniques are capable of producing high quality frequency-modulation halftones, but the calculation of the quantization error and the addition of its fractions to a number of pixels makes them inherently computationally more intensive than the dot-size modulation techniques based on a point-to-point thresholding operation.

☑ 8. Document ID: US 6249304 B1

L11: Entry 8 of 8 File: USPT Jun 19, 2001

DOCUMENT-IDENTIFIER: US 6249304 B1
TITLE: Image forming apparatus and image forming method for forming color images by gray-level image forming technique

Detailed Description Text (19):
The error diffusion method and the dither method have been mentioned above as examples of the gray-tone level image presenting method using the gray-level image device, but the dot area modulation method as well as the dot density modulation method can also be employed.

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Term	Documents
DOT	193401
DOTS	93704
ERROR	705530
ERRORS	303113
SIZ$3	0
SIZ	1902
SIZA	10
SIZAE	2
SIZAI	3
SIZAL	8
SIZAN	4
((DOT NEAR1 (SIZ$3 OR DIAM$3 OR RADI$3 OR AREA$3)) WITH (DOT NEAR1 (DENSIT$3 OR SPAC$3 OR INTENS$3 OR POSITION$3 OR LOCATION$3)) WITH (ERROR ADJ1 DIFFUS$3)).PGPB,USPT,EPAB,JPAB,DWPI,TDBD.	8

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☐ 1. Document ID: US 20020041397 A1

Using default format because multiple data bases are involved.

L13: Entry 1 of 17 File: PGPB Apr 11, 2002

PGPUB-DOCUMENT-NUMBER: 20020041397
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20020041397 A1

TITLE: METHOD OF PROCESSING PIXELS WITH BINARY OR MULTIBIT ERROR DIFFUSION

PUBLICATION-DATE: April 11, 2002

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
ROMBOLA, GREGORY	SPENCERPORT	NY	US	
YANG, DONGLI	ROCHESTER	NY	US	

US-CL-CURRENT: 358/3.05; 382/252

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw. Desc | Ima

☐ 2. Document ID: US RE38235 E

L13: Entry 2 of 17 File: USPT Aug 26, 2003

DOCUMENT-IDENTIFIER: US RE38235 E
TITLE: Scanning recording type printing method and apparatus for increasing image quality by controlling tone dot locations within image pixels

Application Filing Date (1):
19970122

Detailed Description Text (36):
This invention can be applied to a case where a printer is used, which can control the position of dots area-modulated and printed within a pixel not only in the main scanning direction x but also in the auxiliary scanning direction y. FIG. 9 is a scheme for explaining how dots are arranged in pixels (not visible) allocated on the surface of a paper sheet Four types of dot positions, A, B, C and D, are conceivable on the basis of assumptions of a printer. In FIG. 9, there are five sorts of pixel data, i.e. from "0" to "4", which are tone data allocated to the pixels. "0" represents "white" and "4" "black (all over)". To the contrary "1"-"3" represent half tones between them. In the type A, the dot enlarges, starting from the upper right corner in the pixel, with increasing pixel data. In the types B, C and D the dot enlarges, starting from the upper left corner, the lower left corner and the lower the right corner of the pixel, respectively. Consequently, the printer receives the pixel data and information on the type, which are

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then recorded, as indicated in FIG. 9. FIG. 10 indicates information given to the printer for every pixel, in the case where the pixel data and the information thus received are recorded in practice, and FIG. 11 illustrates the recording result. The type information indicating the dot position within the pixel is given alternately for every pixel, such as A, B, A, B, . . ., for the first line, as indicated in FIG. 10, and alternately for every pixel, such as D, C, D, C, . . . for the second line. Further, on and after the third line, the type information for the first line and that for the second line are given alternately and repeatedly. Arbitrary information of "0"-"4" is allocated to each of the pixels, as the pixel data, and this figure shows an example thereof. The result obtained by recording on a paper sheet is such that it is indicated in FIG. 11, where four dots in four pixels, two adjacent pixels in the vertical direction and two adjacent pixels in the horizontal direction, are printed, as if they were gathered together at the center so as to be one point.

Current US Original Classification (1):
358/501

☐ 3. Document ID: US 6563604 B1

L13: Entry 3 of 17 File: USPT May 13, 2003

DOCUMENT-IDENTIFIER: US 6563604 B1
TITLE: Method of gradation reproduction

Application Filing Date (1):
19990601

Detailed Description Text (8):
A dot position decision means 106 determines coordinates of the dot, whose dot size is determined by the dot size decision means 105, and it determines coordinates of the dot by referring to the image data output by the error diffusion calculation means 109. An image output means 110 stores a tone modulated image, for which a dot in the dot size output by the dot size decision means 105 is set on the coordinates determined by the dot position decision means 106.

Current US Original Classification (1):
358/3.09

Current US Cross Reference Classification (1):
358/3.06

☐ 4. Document ID: US 6552824 B2

L13: Entry 4 of 17 File: USPT Apr 22, 2003

DOCUMENT-IDENTIFIER: US 6552824 B2
TITLE: Method of processing pixels with binary or multibit error diffusion

Application Filing Date (1):

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19981217

Brief Summary Text (8):
Grey scale writing systems provide the potential for significant enhancement of image quality for electrophotographic digital copier systems. Grey scale writing systems can utilize either a laser or LED exposure system. Different dot sizes or dot densities can be formed by modulating either the time or density of the exposure system.

Current US Original Classification (1):
358/3.14

☐ 5. Document ID: US 6515768 B1

L13: Entry 5 of 17 File: USPT Feb 4, 2003

DOCUMENT-IDENTIFIER: US 6515768 B1
** See image for Certificate of Correction **
TITLE: Frequency modulation halfstone screen and method for making the same

Application Filing Date (1):
19970918

Brief Summary Text (14):
Perhaps the best known of all "frequency modulation" methods is the error diffusion algorithm. It comes in many variations, but the principle is always the same: the error that occurs as a result of the binarization (or, in a more general context, the quantization) of the image data during the rendering is "diffused" to one or more of the unprocessed pixels. Best known is the Floyd and Steinberg algorithm (Floyd, R. W., and L. Steinberg, "An Adaptive Algorithm for Spatial Greyscale", Proc. SID, vol. 17/2, pp. 75-77). Many variations exist, usually differing in the number of pixels to which the error is diffused and how the error diffusion weights are randomized. The error diffusion techniques are capable of producing high quality frequency-modulation halftones, but the calculation of the quantization error and the addition of its fractions to a number of pixels makes them inherently computationally more intensive than the dot-size modulation techniques based on a point-to-point thresholding operation.

Current US Original Classification (1):
358/3.06

Current US Cross Reference Classification (1):
358/3.19

Current US Cross Reference Classification (2):
358/536

☑ 6. Document ID: US 6445465 B1

L13: Entry 6 of 17 File: USPT Sep 3, 2002

DOCUMENT-IDENTIFIER: US 6445465 B1

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TITLE: Digital halftoning combining dot size modulation screen with dot frequency modulation screen within a single image

Application Filing Date (1):
19990329

Detailed Description Text (17):
The resultant screen pattern, FIG. 10, has a transition from dot size modulation to dot density modulation which is not visually objectionable.

Current US Original Classification (1):
358/1.9

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw. Desc | Ima

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☑ 7. Document ID: US 6330077 B1

L13: Entry 7 of 17 File: USPT Dec 11, 2001

DOCUMENT-IDENTIFIER: US 6330077 B1
TITLE: Image forming apparatus

Application Filing Date (1):
19981124

Detailed Description Text (60):
Further, if each of a dot position (depending on a light-emitting timing) and a dot diameter (a size of a dot) is controlled by the pulse width modulation and output current modulation respectively, correction of a dot can independently be controlled. Consequently, control of a size as well as a position of a dot can accurately be executed, and image quality can largely be effected.

Current US Original Classification (1):
358/1.9

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw. Desc | Ima

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☐ 8. Document ID: US 6049393 A

L13: Entry 8 of 17 File: USPT Apr 11, 2000

DOCUMENT-IDENTIFIER: US 6049393 A
TITLE: Method for enhancing resolution in a printed image

Application Filing Date (1):
19971119

Brief Summary Text (7):
Ink jet printers generally utilize a single ink dot size for printing an image on a receiving medium. In single dot size printing, the average reflectance of a region of an image is typically modulated by a process referred to as "dithering," in which the perceived intensity of an array of dots is modulated by selectively printing the array at

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a predetermined dot density. For example, if a 50 percent local average reflectance is desired, half of the dots in the array are printed. A particular type of dithering is digital halftoning, also known as "spacial dithering." Digital halftoning refers to a process of arranging binary picture elements or "pixels" to create the illusion of continuous-tone images.

Current US Original Classification (1):
358/1.2

Current US Cross Reference Classification (1):
358/1.9

☑ 9. Document ID: US 5892588 A

L13: Entry 9 of 17 File: USPT Apr 6, 1999

DOCUMENT-IDENTIFIER: US 5892588 A
TITLE: Digital halftoning combining dot size modulation screen with dot frequency modulation screen within a single image

Application Filing Date (1):
19971002

Brief Summary Text (13):
The objectives of the present invention are realized in a digital processor implemented structure which operates upon digital image data received from a continuous tone image source. Enhanced digital image data is provided in which there is a compensation for a lack of ability of processing and printing equipment to generate smaller dots normally needed for lower gray level imaging. The process carried out by the structure combines dot size modulation screening with dot frequency modulation screening in a single screening image by varying the density of the dots to improve reproduction of the light tones. The method uses dot size modulation (AM screening) to reproduce the image in the region higher gray scale values and then frequency modulates the output of the dot size screening in the lower gray scale values including that region of the image in which would normally require dot sizes below a user definable dot size limit.

Detailed Description Text (18):
The resultant screen pattern, FIG. 10, has a transition from dot size modulation to dot density modulation which is not visually objectionable.

Current US Original Classification (1):
358/3.19

Current US Cross Reference Classification (1):
358/1.9

Current US Cross Reference Classification (2):
358/3.05

CLAIMS:

1. In a digital halftoning imaging system for press imaging equipment, a method of generating a dot density modulation screen from a dot size modulation screen within the same image, comprising the steps of:

receiving a minimum dot size and setting it as a threshold value;

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receiving a base array for generating dot size modulation halftone screening;

generating a minimum detection array using the minimum dot size threshold value set and the base array received;

receiving continuous tone gray value digital image data;

determining if the gray value of the image data is less than the minimum dot size threshold value;

if the gray value is not less than the minimum dot size threshold value, then obtaining the base array and generating halftone AM (dot size modulation) screening of the image data;

if the gray value is less than the minimum dot size threshold value, then calculating a probability value equal to the gray value divided by the minimum dot size threshold value;

generating a random number in the range of 0 to 1;

determining if the probability value is less than the random number;

if the probability is less than the random number, then generating a null array and generating a halftone AM screening of the image data using that null array;

if the probability is greater than the random number, then generating a minimum dot size threshold value array and generating a halftone AM screening of the image data using that minimum dot array; and

compositing the individually processed halftone image data into image information for use by press imaging equipment.

☑ 10. Document ID: US 5841956 A

L13: Entry 10 of 17 File: USPT Nov 24, 1998

DOCUMENT-IDENTIFIER: US 5841956 A
TITLE: Anti-aliasing for digital printing with dot shape modulation and greyscale

Application Filing Date (1):
19970103

Detailed Description Text (2):
The invention described herein is in terms of use with an electrophotographic printer, specifically, one in which a photoconductive drum is exposed by light from a spatial light modulator. The invention is also useful with electrophotographic printers with other exposure devices. Furthermore, the printer need not be electrophotographic, and can be any printer that is capable of both dot density and dot area modulation. In general, the invention is directed to a method of combining density modulation and area modulation to reduce aliasing.

Detailed Description Text (7):
FIGS. 3 and 4 illustrate two methods of printing object 11 in accordance with the invention. As explained below, both dot area modulation and dot density modulation have been used to reduce aliasing.

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Current US Original Classification (1):
358/1.9

Current US Cross Reference Classification (4):
358/3.26

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWMC | Draw Desc | Ima

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☐ 11. Document ID: US 5832122 A

L13: Entry 11 of 17 File: USPT Nov 3, 1998

DOCUMENT-IDENTIFIER: US 5832122 A
TITLE: Method of processing image data

Application Filing Date (1):
19960315

Brief Summary Text (6):
Generally, gradations of tone of halftone dot images can be expressed by either one of two processes. One of the processes is referred to as an amplitude modulation process (AM process) by which the size of dots or pixels is modulated according to multivalued image data. According to the other process, which is referred to as a frequency modulation process (FM process), the size of dots remains unchanged, but the density of dots is modulated according to multivalued image data. There are mainly two types of the frequency modulation process, i.e., an error distributing process and a threshold process. According to the error distributing process, when multivalued image data are to be converted into binary image data using predetermined threshold data, errors produced between the multivalued image data and the binary image data are distributed into surrounding pixels, generating binary image data having desired densities. According to the threshold process, multivalued image data are converted into binary image data using threshold data that are established as a dither matrix.

Current US Cross Reference Classification (1):
358/3.18

Current US Cross Reference Classification (2):
358/3.26

Current US Cross Reference Classification (3):
358/406

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWMC | Draw Desc | Ima

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☑ 12. Document ID: US 5619242 A

L13: Entry 12 of 17 File: USPT Apr 8, 1997

DOCUMENT-IDENTIFIER: US 5619242 A
TITLE: Image forming apparatus with edge point detector based on image density charge

Application Filing Date (1):

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19940111

Current US Cross Reference Classification (1):
358/300

CLAIMS:

3. An apparatus for forming an image on a photoreceptor as a two dimensional array of dot images arranged in horizontal and vertical directions, the image forming apparatus comprising:

means for sequentially inputting image density data of pixels into the apparatus, each image density data representing an image density level in a pixel of the image;

edge detecting means for detecting an edge point in the image by obtaining a value of an image density change from a pixel to a succeeding pixel by comparing corresponding image density levels from the image density data, and by classifying each pixel, based on the image density change value, into one of a predetermined number of classes, the predetermined number of classes including at least

an edge-starting pixel where the value of the image density change is larger than a predetermined positive threshold value,

an edge-ending pixel where the value of the image density change is smaller than a predetermined negative threshold value and

a non-edge pixel where the value of the image density change lies between the predetermined positive threshold value and the predetermined negative threshold value;

scanning means for scanning the photoreceptor with a spot light to form a dot image on the photoreceptor; and modulating means for modulating the exposing light based on the image density data of pixels to change size of the dot image so that density levels of the image are reproduced, the modulating means including means for shifting the position of the dot image in accordance with the edge-starting pixel and the edge-ending pixel to a direction so that the dot image is shifted toward a neighboring dot of the dot image.

☐ 13. Document ID: US 5588094 A

L13: Entry 13 of 17 File: USPT Dec 24, 1996

DOCUMENT-IDENTIFIER: US 5588094 A
TITLE: Post-processing bit-map decimation compensation method for printing high quality images

Application Filing Date (1):
19940103

Brief Summary Text (9):
In single dot size printing, average reflectance of a region of an image is typically modulated by a process referred to as "dithering" in which the perceived intensity of an array of dots is modulated by selectively printing the array at a predetermined dot density. For example, if a 50 percent local average reflectance is desired, half of the dots in the array are printed.

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Current US Original Classification (1):
358/1.9

Current US Cross Reference Classification (1):
358/3.06

Current US Cross Reference Classification (2):
358/3.18

Current US Cross Reference Classification (3):
358/3.2

☐ 14. Document ID: US 5189521 A

L13: Entry 14 of 17 File: USPT Feb 23, 1993

DOCUMENT-IDENTIFIER: US 5189521 A
**** See image for Certificate of Correction ****
TITLE: Image forming apparatus and method for correction image density non-uniformity by reading a test pattern recorded by the apparatus

Application Filing Date (1):
19910606

Brief Summary Text (11):
As is well known, in a recording system capable of modulating a dot size or a dot density, recording elements modulate recording dot sizes in accordance with an input to attain multi-gradation recording. For example, in an ink-jet recording head based on a piezo system or a system utilizing thermal energy, drive voltages or pulse widths of signals applied to discharging energy generating elements such as piezo elements, electricity-heat converters, and the like are modulated according to an input signal. In a thermal head, drive voltages or pulse widths of signals to be applied to heaters are modulated according to an input signal. By utilizing these operations, it is possible to make uniform dot sizes or dot densities of the recording elements, thereby obtaining a uniform density distribution, as shown in FIG. 26E.

Current US Original Classification (1):
358/296

Current US Cross Reference Classification (4):
358/518

☐ 15. Document ID: US 4926248 A

L13: Entry 15 of 17 File: USPT May 15, 1990

DOCUMENT-IDENTIFIER: US 4926248 A
TITLE: Scanning recording type printing method and apparatus for increasing image quality by controlling tone dot locations within image pixels

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Application Filing Date (1):
19880823

Detailed Description Text (36):
This invention can be applied to a case where a printer is used, which can control the position of dots area-modulated and printed within a pixel not only in the main scanning direction x but also in the auxiliary scanning direction y. FIG. 9 is a scheme for explaining how dots are arranged in pixels (not visible) allocated on the surface of a paper sheet. Four types of dot positions, A, B, C and D, are conceivable on the basis of assumptions of a printer. In FIG. 9, there are five sorts of pixel data, i.e. from "0" to "4", which are tone data allocated to the pixels. "0" represents "white" and "4" "black (all over)". To the contrary "1"-"3" represent half tones between them. In the type A, the dot enlarges, starting from the upper right corner in the pixel, with increasing pixel data. In the types B, C and D the dot enlarges, starting from the upper left corner, the lower left corner and the lower the right corner of the pixel, respectively. Consequently, the printer receives the pixel data and information on the type, which are then recorded, as indicated in FIG. 9. FIG. 10 indicates information given to the printer for every pixel, in the case where the pixel data and the information thus received are recorded in practice, and FIG. 11 illustrates the recording result. The type information indicating the dot position within the pixel is given alternately for every pixel, such as A, B, A, B, . . . , for the first line, as indicated in FIG. 10, and alternately for every pixel, such as D, C, D, C, . . . for the second line. Further, on and after the third line, the type information for the first line and that for the second line are given alternately and repeatedly. Arbitrary information of "0"-"4" is allocated to each of the pixels, as the pixel data, and this figure shows an example thereof. The result obtained by recording on a paper sheet is such that it is indicated in FIG. 11, where four dots in four pixels, two adjacent pixels in the vertical direction and two adjacent pixels in the horizontal direction, are printed, as if they were gathered together at the center so as to be one point.

Current US Original Classification (1):
358/501

Current US Cross Reference Classification (5):
358/3.02

Current US Cross Reference Classification (6):
358/3.26

Current US Cross Reference Classification (7):
358/533

Current US Cross Reference Classification (8):
358/540

☐ 16. Document ID: US 4873537 A

L13: Entry 16 of 17 File: USPT Oct 10, 1989

DOCUMENT-IDENTIFIER: US 4873537 A
TITLE: Image recording apparatus for producing a plurality of pulse width modulated signals on the basis of image data

Application Filing Date (1):
19890320

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Brief Summary Text (8):
On the other hand, in a recording apparatus capable of recording plural density levels, it has been tried to increase the number of density levels by the use of plural density levels while maintaining a constant matrix size. For example, in an ink jet printer, the multiple density levels can be achieved by the size of the dots or the density of ink, and, in an electrophotographic laser beam printer, the multiple density levels can be attained by dividing the matrix in the main scanning direction and conducting pulse width modulation, as disclosed in the Japanese Patent Laid-open 99864/1982.

Current US Cross Reference Classification (1):
358/296

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw Desc | Ima

☑ 17. Document ID: JP 60242771 A

L13: Entry 17 of 17 File: JPAB Dec 2, 1985

DOCUMENT-IDENTIFIER: JP 60242771 A
TITLE: PICTURE IMAGE RECORDING METHOD

Abstract Text (1):
PURPOSE: To attain picture recording with high gradation and high resolution by reproducing a picture with dot density modulation at a low picture density level and with dot area modulation at a high picture density level to expand remarkably a reproducible density range.

Application Date (1):
19850424

Current US Cross Reference Classification (1):
358/FOR.174

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw Desc | Ima

Clear | Generate Collection | Print | Fwd Refs | Bkwd Refs | Generate OACS

Term	Documents
(12 AND 3 AND 2).PGPB,USPT,EPAB,JPAB,DWPI,TDBD.	17
(L12 AND L2 AND L3).PGPB,USPT,EPAB,JPAB,DWPI,TDBD.	17

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